

1 **WIRELESS REPEATER WITH DIVERSE COMMUNICATIONS**
2 **INTERFACE CAPABILITY AND THE METHOD OF MANAGING THE**
3 **SAME**

4 **BACKGROUND OF THE INVENTION**

5 1. Field of the Invention

6 The present invention is related to a wireless repeater with diverse
7 communications interface capability, and more particularly to an RF repeater
8 that can automatically detect and switch to an appropriate wireless
9 communications interface compatible with the target system, that may only
10 support a particular version of wireless communications protocols, for
11 establishing bi-directional communication, and the method of managing
12 multiple versions of communications system drivers.

13 2. Description of Related Art

14 Wireless communications technology has now become widely used in
15 digital data communications and personal communications. Personal area
16 networks (PANs) and wireless local area networks (WLANs) are some of the
17 latest examples that the technology has to offer, which can provide high speed
18 data transmission through open air and allow users to access the network
19 resources from any place and at any time with no need of setting up the physical
20 cable connections. An ordinary user is able to use a mobile phone, a personal
21 digital assistant (PDA), a notebook computer or a flat panel computer to access
22 the Internet domain. When the digital computer is configured with a Bluetooth
23 module and a wireless repeater, it can be operated as a base station, through
24 which a bi-directional communication link can be established with one or more

mobile stations, such as cellular phones, for voice and data communications. The communication link can be operated as mobile station-to-base station or base station-to-mobile station, or base station-to-base station, or it can be used to create a personal area network (PAN) or a wireless local area network (WLAN).

However, it is unfortunate that currently used mobile and wireless communications systems are not yet standardized, so most of the personal and mobile communications manufacturers choose one version of a wireless communications system to put into their communications products. This restriction means these communications products may only support a particular version of the wireless communications protocols. Often, there is a compatibility problem across different systems, as the system drivers installed in the communications devices at respective ends might not be the same version.

To promote more extensive use of wireless communications products free from the compatibility problems, future communication devices need to be designed for use with at least two different wireless communications systems.

SUMMARY OF THE INVENTION

The main object of the present invention is to provide a method of managing a wireless repeater having a diverse communications interface capability, whereby the wireless repeater is able to automatically detect and switch to an appropriate wireless communications interface compatible with a target system, that may only support a particular version of wireless communications protocols, so that the user of a personal computing device is able to engage in mobile communications, or to log onto the Internet for web services.

1 The second object of the present invention is to provide a portable type
2 wireless repeater equipped with a diverse communications interface capability.

3 The third object of the present invention is to provide a wireless repeater
4 that can be operated as a net phone for VoIP applications, whereby the telephone
5 rates of the user can be considerably reduced.

6 The fourth object of the present invention is to provide a wireless
7 repeater that has an alert prompting function, whereby the prompter will
8 automatically notify the user of an incoming call by means of vibrations, light
9 beams or ringing tones, or when the repeater ceases the existing communication
10 link.

11 According to the present invention, the wireless repeater is prepared
12 with multiple communications system drivers, whereby the wireless repeater is
13 able to support many commonly used wireless applications protocols, and these
14 different communications system drivers are controlled by an interface
15 mechanism.

16 According to the first aspect of the present invention, the method of
17 managing the wireless repeater having a diverse communications interface
18 capability comprises the steps of:

19 preparing the wireless repeater with at least two different
20 communications system drivers;

21 creating a different communications module for each wireless
22 communications system serving as a gateway to the particular system, such that
23 the personal computing device through the wireless repeater is able to establish
24 bi-directional communication with the target system, such as a digital computer

with a Bluetooth module, mobile communications systems (GPRS/GSM), and a wireless local area network (WLAN);

enabling the wireless repeater to make regular communication links with the personal computing device through the first wireless communications module;

enabling the wireless repeater to make regular communication links with the GPRS/GSM system, and a wireless local area network (WLAN) through the mobile communications module, and to detect whether the data signals come from an incoming call or outgoing call for initiating a call interrupt; and

enabling the wireless repeater to make a connection with the access point of a wireless local area network (WLAN) through a WIFI communications module, on the condition that the personal computing device has successfully logged onto the network.

Since the interface mechanism is embedded in the control circuitry of the wireless repeater, the related hardware and software implementation costs can be considerably reduced.

According to the second aspect of the present invention, a wireless repeater is constructed comprising:

- a microprocessor serving as control hub;
- a first wireless communications module for enabling the personal computing device to establish bi-directional communication;
- a mobile communications module, being connected to the microprocessor, for making connection with two mobile communications systems (GPRS/GSM);

1 a WIFI communications module, also being connected to the
2 microprocessor, for making connection with the wireless local area network
3 (WLAN); and

4 a CODEC interface module, being connected between the first wireless
5 communications module and the microprocessor, for encoding and decoding
6 voice data in the data transmission process.

7 Through the interface mechanism of the microprocessor, the wireless
8 repeater is able to select an appropriate wireless/mobile communications
9 interface from among multiple wireless communications systems for
10 establishing a bi-directional communication with the target system.

11 The above first wireless communications module can be a Bluetooth
12 module.

13 The above mobile communications module can be a GSM/GPRS
14 interface.

15 The above WIFI communications module can be a transceiver for the
16 wireless local area network (WLAN).

17 The above wireless repeater further includes a third wireless
18 communications module, which enables infra-red transmission of voice and
19 digital data bi-directionally.

20 The above personal computing device can be a notebook computer, a
21 flat panel computer or a personal digital assistant (PDA).

22 The present invention enables the personal computing device to call out
23 or receive outside calls through the mobile communications module of the
24 repeater.

1 According to the third aspect of the present invention, the personal
2 computing device configured with a wireless repeater is able to operate with a
3 net phone (VoIP) for making telephone connection with a remote net phone with
4 the same capability through the call relay function of the repeater, on the
5 condition that the personal computing device has successfully logged onto the
6 network.

7 The present invention enables the wireless repeater to operate with a
8 headset that can support the high speed port (HSP) for calling out or receiving
9 calls.

10 According to the fourth aspect of the present invention, the wireless
11 repeater further includes a prompter, also being connected to the microprocessor,
12 which is able to produce vibrations, light beams, or ringing sound to alert the
13 user when a call is received or when the repeater ceases the existing
14 communication link with the wireless local area network (WLAN).

15 Other objectives, advantages and novel features of the invention will
16 become more apparent from the following detailed description when taken in
17 conjunction with the accompanying drawings.

18 BRIEF DESCRIPTION OF THE DRAWINGS

19 Fig. 1 is conceptual diagram of a possible configuration for the present
20 invention;

21 Figs. 2A-2D show a block diagram of the system architecture of the
22 present invention;

23 Figs. 3A-3H show a detailed circuit diagram of the microprocessor;

24 Figs. 4A-4F show a circuit diagram of the first wireless communications

1 module and part of the CODEC interface module;

2 Figs. 5A-5C show a circuit diagram of the rest of the CODEC interface
3 module;

4 Figs. 6A-6E show a circuit diagram of the mobile communications
5 module;

6 Figs. 7A-7C show a circuit diagram of the WIFI communications
7 module;

8 Figs. 8A-8E show a circuit diagram of the prompter; and

9 Figs. 9A-9D is a circuit diagram of the power supply module.

10 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

11 The present invention is illustrated through a preferred embodiment as
12 shown in Fig. 1, in which a wireless repeater (101) serves as an intermediate
13 relay station between a personal computing device (102), a mobile
14 communications network (103), and a wireless local area network WLAN (104);
15 and the wireless repeater (101) has a diverse communications interface
16 capability, enabling the wireless repeater (101) to switch a communications
17 system driver on a regular basis; wherein

18 the mobile communications network (103) contains two different
19 communications systems: GPRS and GSM.

20 According to the preferred embodiment of the invention, the wireless
21 repeater (101) is set up as follows:

22 using a first wireless communications module (20), as shown in Fig. 4,
23 to make connection with the personal computing device (102);

24 using a mobile communications module, as shown in Figs. 6A-6E, to

1 make connection with the two systems (GPRS/GMS) in the mobile
2 communications network (103); and
3 using a WIFI communications module, as shown in Figs. 7A-7C, to
4 make a connection with the wireless local area network WLAN (104).

5 Such being the case, the wireless repeater (10) is able to establish regular
6 communication links with the personal computing device (102) through the first
7 wireless communications module (20), through which the personal computing
8 device (102) is able to establish regular communication links with a mobile
9 communications network (GPRS/GSM) or a wireless local area network
10 (WLAN) (104) using the mobile communications module or the WIFI
11 communications module.

12 The mobile communications network (103) includes a GPRS system and
13 a GSM system, wherein the GPRS system maintains a regular communication
14 link with the wireless repeater (101), and the personal computing device (102) is
15 able to send out or receive electronic mails or use web services through the first
16 wireless communications module (20) of the wireless repeater (101).

17 The personal computing device (102) is configured with the wireless
18 repeater (101) such that the personal computing device (102) is able to call out or
19 receive phone calls to/from the GSM system through the first wireless
20 communications module (20) and second mobile communications module.

21 When a call request is received, the existing link between the wireless repeater
22 (101) and the GPRS system is halted temporarily, and the system enters a
23 waiting period until the termination of the incoming call and then resumes the
24 previous GPRS system automatically.

1 If the wireless repeater (101) is not located in the broadcasting range of
2 the WLAN (104), the personal computing device (102) is still able to call out or
3 receive calls through the first wireless communications module (20) using the
4 GSM system. Once the wireless repeater (101) is within the broadcasting range
5 of the WLAN (104) and is successfully authenticated after log-in, the user can
6 use the personal computing device (102) through the wireless repeater (101) to
7 make a connection with the WLAN (104) for placing a telephone call through
8 the net phone (VoIP) to a remote house phone or net phone with the same
9 capability.

10 In the preferred embodiment, the above personal computing device (102)
11 can be either a notebook computer, a flat panel computer, or a personal digital
12 assistant (PDA), and the control signals and voice data between the wireless
13 repeater (101) and the personal computing device (102) are transmitted through
14 a serial parallel port (SPP) and a high speed port (HSP), enabling the personal
15 digital assistant (PDA) to call out or receive calls directly. Alternatively, the
16 wireless repeater (101) can also have a Bluetooth headset (BTHS) to call out or
17 receive calls, as long as the wireless repeater (101) and the Bluetooth headset
18 (BTHS) are connected by a high speed port (HSP).

19 Besides the personal digital assistant (PDA), the above personal
20 computing device (102) can also be notebook computer or a flat panel computer.

21 From the foregoing, it becomes apparent, in the present invention, the
22 wireless repeater (101) serves as an intermediate relay station between a base
23 station and a mobile station, and the personal computing device (102) configured
24 with the wireless repeater (101) can automatically select an appropriate

1 communications system driver compatible with the target system from among
2 multiple communications system drivers, for bi-directional communication, thus
3 obviating the compatibility problem in association with different versions of
4 wireless communications protocols.

5 Since the interface mechanism and multiple communications driver
6 circuits are installed in the wireless repeater, the related hardware and software
7 implementation costs can be considerably reduced.

8 It is possible to use either the GSM system or the net phone (VoIP) for
9 making telephone connection with the other phone on the remote end. However,
10 if the user chooses to use the net phone (VoIP) instead of the GSM system, the
11 telephone bill can be considerably reduced. To realize the above scheme, the
12 architecture of the wireless repeater (101), in one preferred embodiment as
13 shown in Figs. 2A-2D, comprises:

14 a microprocessor (10), as shown in Figs. 3A-3H, serving as the control
15 hub;

16 a first wireless communications module (20), as shown in Figs. 4A-4F,
17 for making connection with the personal computing device (102);

18 a mobile communications module (30), being connected to the
19 microprocessor (10), for making connection with the two mobile
20 communications systems (GPRS/GSM);

21 a WIFI communications module (40), being connected to the
22 microprocessor (10), for making connection with a WLAN (104);

23 a CODEC interface module (50), as shown in Figs. 5A-5C, being
24 connected in between the first wireless communications module (20) and the

1 microprocessor(10), for encoding and decoding voice and digital data in the data
2 transmission process;

3 a power supply module (60), as shown in Figs. 9A-9D, for providing the
4 operating voltage to all system components;

5 a prompter (70), as shown in Figs. 8A-8E, being connected to the
6 microprocessor(10), for generating vibrations, ringing tones or light beams to
7 alert the user when an incoming call is received, or when the wireless repeater
8 (101) has ceased the existing link with the WLAN (104).

9 The first wireless communications module (20) can be a Bluetooth
10 module.

11 The mobile communications module (30) can be a GSM/GPRS interface
12 that supports GPRS and GSM systems.

13 The WIFI communications module (40) can be transceiver for a WLAN
14 (104) that supports 802.11b communications protocols.

15 The CODEC interface module (50), as shown in Figs. 4, 5 is formed by a
16 PWM CODEC (51), a pair of multiplexers (52)(53) and a voice CODEC (54),
17 wherein the PWM CODEC(51) is connected to the first wireless
18 communications module (20) and further through the multiplexer (52) (53)
19 connected to the voice CODEC (54), and through the voice CODEC (54)
20 connected to the microprocessor (10), wherein one multiplexer (53) is connected
21 to a headset plug-in socket (55), whereby the multiplexers (52) (53) are
22 responsible for switching the audio data transmission path between the first
23 wireless communications module (20) and the headset connected through the
24 voice CODEC (51) and the microprocessor (10).

1 The prompter (70), as shown in Fig. 8, is formed by a pair of indicator
2 LEDs (71) (72), a vibrator (73), and a speaker (74) and related driver circuits,
3 wherein the driver circuit is connected to the microprocessor (10), whereby
4 when an incoming call is received by the wireless repeater (101), the speaker (74)
5 starts to emit ringer tones; alternatively, the user can choose to use the vibrator
6 (73) to produce rhythmic vibrations to alert the user of incoming calls; also, the
7 prompter (70) is also activated when the wireless repeater (101) ceases the
8 existing link with the WLAN (104).

9 Further, the wireless repeater (101) can also have a third wireless
10 communications module (80), as in the preferred embodiment, which is an
11 infra-red transmission interface, being connected to the microprocessor (10), for
12 data communications bi-directionally.

13 The microprocessor (10) is also connected to a memory unit (11),
14 wherein the memory unit (11) has flash RAM and DRAM for saving operation
15 data and program instructions.

16 From the foregoing, the present invention has constructed a wireless
17 repeater prepared with multiple mobile/wireless communications system drivers,
18 whereby the microprocessor will be able to choose an appropriate wireless or
19 mobile communications system driver compatible with the target system to
20 establish bi-directional communication. The wireless repeater, in accordance
21 with the present invention, has the following advantages over prior art:

22 1. Versatility - Providing a choice of an appropriate wireless
23 communication system driver from among several resident in the wireless
24 repeater for preparing bi-directional communication with a target system that

1 may only support a particular version of wireless communications protocols;
2 2. Low Use-Costs - Being able to use the net phone (VoIP) through a
3 wireless local area network (WLAN) to establish a communication link between
4 with a remote phone for reduced telephone rates;

5 3. Cost Effective System Enhancement - Having multiple
6 communications system drivers integrated into the wireless repeater can reduce
7 the software and hardware implementation costs and improve the system
8 performance;

9 4. Mobility: the portable design of the wireless repeater provides the
10 greatest mobility for a communication link between the base station and the
11 mobile station.

12 It is to be understood, however, that even though numerous
13 characteristics and advantages of the present invention have been set forth in the
14 foregoing description, together with details of the structure and function of the
15 invention, the disclosure is illustrative only, and changes may be made in detail,
16 especially in matters of shape, size, and arrangement of parts within the
17 principles of the invention to the full extent indicated by the broad general
18 meaning of the terms in which the appended claims are expressed.